

ANATOMICAL VARIATIONS OF ACCESSORY NASAL SINUSES*

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A TREATISE dealing with anatomy, of necessity is one that is not new. But since sinuses have such various ramifications, sizes, and wall limitations, it may be interesting to review the subject. A knowledge of the anatomical variations of the nasal accessory sinuses is necessary if the signs of complications, which show themselves through their bordering walls, are to be recognized and if proper drainage, which is the only hope of cure, is to be established.

FRONTAL SINUSES

The frontal sinuses may be entirely absent, or may be present only on one side, or may occur on both sides with one side overlapping the other either in front or behind. They may extend from the roof of the orbit to as much as forty millimeters into the spongosum of the frontal plate. They may extend posteriorly over almost the entire roof of the orbit back to the lesser wing of the sphenoid, or the depth may be but a few millimeters. This is most important in selecting the operation of preference when it is necessary to establish surgical drainage. The shallow sinus makes operation hazardous by the intranasal route, for fear of coming into the anterior fossa of the brain, while the deep sinus makes any of the radical operations less favorable for a cure, and especially those which have been worked out to preserve facial contour. The larger the sinuses the thinner the walls and the more closely do such sinuses encroach upon vital structures. The posterior wall may be so thin that only a tissue-paper thickness of bone is between it and the brain cavity. The floor of the frontal sinus, which is the roof of the orbit, is equally as thin and in some cases a dehiscence in the bone is present. In these cases destruction of the lining membrane by disease or in the course of operation may result in eye complications.

Recently I have had two patients come to me only after the anterior wall, which is the plate of the frontal, was completely eroded; both reporting because of a prominence on the forehead, following a protracted period of headache. The prominence in one patient was in the center, and at operation it was discovered that both sinuses opened into this prominence. In the other patient the prominence was over the left sinus, but the left sinus extended thirty millimeters to the right of the median line, and was situated posterior to its fellow of the opposite side.

When at operation it is revealed that the posterior wall of the frontal is bulged far forward, it may be an overlapping of the sinus of the oppo-

site side posteriorly, or a bulla frontalis which is pushed up from the anterior ethmoids. The ostium of the frontal varies greatly in size and shape from the type which is very short and straight and which is easily entered, to one that is long, narrow and cork-screw in its course. The hiatus semilunaris may be very narrow as a result of an overhanging of the uncinate process or the pushing forward of the bulla ethmoidalis. In such cases it may be necessary to remove the uncinate or the bulla in order to probe the sinus. While the frontal more often opens into the hiatus, it may open into an adjacent anterior ethmoid cell or into the bulla, or the hiatus may end in a blind ethmoid cell. Ethmoid cells may open into the hiatus as well as the frontal, which not infrequently is the cause of difficulty in reëntering a frontal after it has once been probed successfully. In such cases a notation should be made upon the patient's history chart.

At the present time I have a patient who has two distinct ostia leading into a very large left frontal. X-ray has not shown any irregularity in the sinus, but I am able to wash from the sinus separate quantities of pus from the two openings.

In one of the slides photographed from an actual specimen, and which will be thrown upon the screen, the individual had three separate frontal cavities; the left cavity opening into the usual place, the middle cavity into an anterior ethmoid and then into the hiatus, and the right cavity opening directly into the right maxillary sinus.

MAXILLARY SINUSES

The walls of the maxillary sinuses may vary from the normal to an almost complete absence, a mere slit being present on one or both sides. In such cases both may be so small that the canine fossa is so receding that considerable deformity of facial contour is noticeable. The recognition of such abnormalities is important in deciding the route of approach when it is necessary to radically operate such sinuses.

The Stewerman-Canfield operation, which I personally prefer, would not be applicable in these cases with receding anterior wall, nor would the preturbinal procedure, but the Caldwell-Luc operation would be better.

While variations in the maxillary sinus are less common than in other sinuses, the posterior superior angle may be pushed high up, mesial to the orbit and almost completely displacing the posterior ethmoids of that side and perhaps extending to the floor of the frontal. In one section we discovered that the sinuses were joined. Or a complete bony partition through the antrum dividing it into an anterior and posterior section may be found. In such cases the posterior cavity has its opening into the posterior ethmoids. In a patient in whom both cavities were filled with pus, the x-ray would show it to be one cavity and thus be of little assistance. But should only

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one cavity be involved, the x-ray would clarify the picture. In suspicious cases it is best to irrigate the sinus and have another exposure, or fill the cavity with lipiodol or other opaque substances.

Perforation of the maxillary sinus is very rare. A swelling occurring in the canine fossa never occurs as the result of infection within, but is due to congenital or an inflammatory cyst.

The infra-temporal wall may be very thin, as is also the infra-orbital wall, and occasionally dehiscences are present so that complications can arise from these two walls as a result of pressure from irrigation or from forcibly removing the membrane from them during the course of an operation. Emphysema of the eye may occur as a result of a sudden blast of sneezing when such a dehiscence is present in the infra-orbital wall.

The ostium may be very small or it may be so large that a cyst the size of a small cherry could be washed out of the antrum. An accessory opening is present in many cases and it usually occurs in the inferior posterior quadrant.

ETHMOIDS

Ethmoid cells may open directly into the infundibulum or may push up behind the frontal sinus to form the bulla frontalis. Here the diagnosis is only made when a radical frontal is done and the bulging wall is seen behind. The cribriform plate may fail to unite with the orbital, thus forming the fovea ethmoidalis which pushes out between the superior wall of the orbit and the inferior wall of the frontal to the extent that it may cover the whole orbit, extending back to the lesser wing of the sphenoid, and as happened in one instance, extending completely around the optic nerve.

The lamina papyracea in some instances is so thin that dehiscences are present; the bone being of tissue-paper thickness and allowing infection from infected ethmoids to pass through the mucous membrane and the thin bone by way of small venules and lymph channels. It is not uncommon, in the course of operation on the ethmoids, to break through the orbital wall. Such an accident may cause serious complications to the eye, although those are not so dangerous as they may appear. The posterior ethmoids may extend back and be reflected over the sphenoid so that their thin lateral walls are in direct contact to the optic nerve, the carotid and cavernous sinus. It is in such cases that complications resulting in a retrobulbar neuritis are liable to occur. Or by infection spreading through small venules into the cavernous sinus, a thrombosis may be the result. Not infrequently a large cell pushes out into the middle turbinate forming the bulla ethmoidalis. Sometimes in removal of the agger nasi, one may come into a specially located infundibular ethmoid cell.

SPHENOIDS

Sphenoid sinuses are usually equal in size, and are separated from the posterior ethmoids by the recessus speno-ethmoidalis. They are divided by

a perpendicular partition which is the continuation of the crista galli, but this partition may vary considerably. It may be far to one side or the other so that a large cavity opens into one naris and a very small cavity into the other. Or the sinuses may be divided by horizontal partition, one being above the other, and, as will be seen in one of the slides, the upper sinus, in one instance, opens into the lower sinus by an opening in the partition. In the case of a very small cell on one side it may be completely overlapped by its fellow of the other. Sphenoid sinuses may be so large that they extend as far back as the clevus and anteriorly may so extend that the posterior ethmoids are pushed forward. The average distance from the anterior nasal spine to the posterior sphenoidal wall, is about seven and one-half centimeters, but may vary considerably. When the posterior wall is pushed back to the clevus, the distance may be nine or more centimeters, while if the sphenoid cavity is small and set forward, the distance will be less than seven centimeters. The anterior upper part of the sphenoid wall may be reflected back throwing the upper part of the cavity into the posterior ethmoids. This can only be recognized at the time of operation or afterward when the wound is healed. Pus would still appear upon the face of the sphenoid if only the ethmoid had been entered.

The lateral walls of the sphenoid may be of tissue-paper thickness with the carotid and optic nerve bulging into its cavity. Here, as in the posterior ethmoids, may be found the source of infection and complications to the optic nerve and cavernous sinus.

The lantern slides photographed from actual specimens will show clearly most of these variation that have been discussed.

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DISCUSSION

C. LATIMER CALLANDER, M. D. (450 Sutter Street, San Francisco).—I have read with great interest Doctor Budge's article on anatomical variations of accessory nasal sinuses. A discussion such as this is always timely, especially inasmuch as he joins his anatomic information with points of clinical interest and thus furnishes pegs upon which to hang anatomic knowledge.

His paper is particularly valuable, it seems to me, as indicating the paths along which infection travels which complicates sinus disease. He speaks interestingly of the extraordinary variations in the extent of the ethmoid sinus and he especially stresses the very shallow sinus and the danger of intranasal approach for drainage of this sinus where the anterior cerebral fossa may be damaged. I am interested in the analogy which he draws between the frontal sinus and the anterior ethmoids. The frontal sinus, to me, has always appeared a glorified anterior ethmoid cell and one in which the most extraordinary variations occur with regard to its drainage path into the nose.

The warning that he gives on dehiscences that may occur in the bordering walls of all of the sinuses is a timely one, not only from the point of view of operative damage, but from the possibility of chronic infection involving the adjacent structures. Particularly does this seem to be important in relation to the thin upper and outer wall at the apex of each nasal fossa where the most thorough ethmoid exenteration places the anterior cerebral fossa in danger.